Fuel Reformer

A fuel conversion system invented t Argonne brings fuel-cell-powered vehicles closer to eality. The device is an on-board methanol fuel reformer hat uses a common, inexpensive catalyst to convert nethanol into the hydrogen needed to run fuel cells.

he Argonne methanol fuel reformer:

- reduces startup time from 30 minutes to less than 1 minute
- eliminates the need to store gaseous hydrogen on a vehicle
- vastly improves the responsiveness of the fuel cell power system.

he device has several other attractive characteristics: it rovides good dynamic response for vehicle acceleration nd braking, is lightweight and compact for on-board use, nd operates at safe, low temperatures (250 to 400°C).

his reformer is small enough to fit under the hood of a ompact car beside a polymer-electrolyte fuel cell. Such vehicle would have nearly zero emissions, without the imited range and recharging requirements of a purely

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Argonne National Laboratory is committed to developing high-quality, cost-effective products that meet the nation's goals of improving energy efficiency, reducing emissions, and manufacturing affordable, advanced-technology vehicles.

The Laboratory has forged partnerships with many firms in the energy and transportation sectors over the past two decades. Our location, right in the nation's heartland and industrial center, makes cooperative research easily accessible and cost-effective.

Argonne's fuel cell program, comprising leading-edge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges of creating the new generation of electric and hybrid vehicles. These programs are supported by the Department of Energy and U.S. industry.

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FUEL CELL

Research and Technology

Fuel Processin

Catalyst Characterizatio

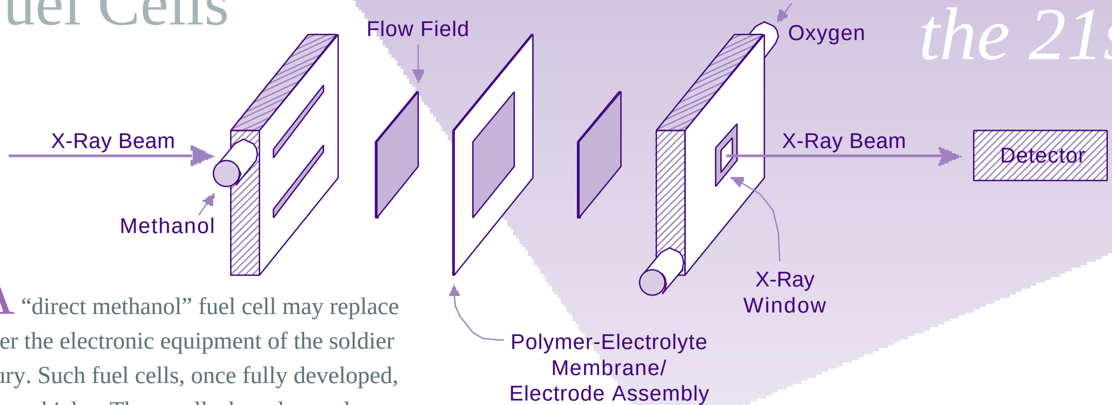
Advanced Fuel Cell Concept

Systems Modelin

ARGONNE NATIONAL LABORATORY

Fuel cell research at Argonne – power for electric vehicles of the 21st century

Electrocatalysts for Fuel Cells



A "direct methanol" fuel cell may replace atteries to power the electronic equipment of the soldier f the 21st century. Such fuel cells, once fully developed, night also power vehicles. These cells, based on polymer-lectrolyte technology, could provide simple, efficient, and lean power sources that would run directly on methanol, fuel that can be made from renewable sources. However, nethanol degrades the anode catalysts in current polymer-lectrolyte fuel cells. Argonne is working to characterize he degradation mechanisms of the electrocatalysts to nprove the activity and lifetime of direct methanol fuel ells. The researchers are conducting an in-depth electro-hemical and X-ray spectroscopic study of platinum-uthenium alloys, the best anode catalyst materials currently vailable. Synchrotron X-rays are used to study anode eactions in real time in an operating fuel cell. The results vill allow the researchers to design better catalysts for igher power output.

Solid Oxide Fuel Cells

iolid oxide fuel cells offer high power density and can run n any type of hydrocarbon fuel without extensive fuel rocessing. They are also potentially the least expensive mong current fuel cell candidates. However, with present

The Argonne fuel cell group is developing new electrodes and electrolytes to lower this operating temperature to 450-500°C. This would make solid oxide fuel cells valuable for applications with frequent startups. The lower operating temperature would also lead to greater durability and lower materials and manufacturing costs.

The group has shown that a cell with a new ceria-based electrolyte achieves almost 100% of its theoretically expected open-circuit voltage when operating at 500°C with air and hydrogen fuel. It performs nearly as well with methanol fuel. New cathode materials and thinner electrolytes (0.04-0.07 mm) are being tested to improve performance further.

Project Management

Argonne has provided 10 years of technical support to the U.S. Department of Energy (DOE) in managing its

Fuel-cell-powered buses, like the one shown here, were successfully developed under Argonne's technical guidance; these buses have better fuel economy than diesel buses and reduce emissions by more than 99%. Argonne continues to provide technical management for DOE's major ongoing contracts with General Motors, Ford, and Chrysler, where 50-kW (67-hp automotive fuel cells are being developed for the Partnership for a New Generation of Vehicles (PNGV). Argonne also manages other efforts to develop fuel cell system components, such as fuel processors, hydrogen storage devices, and air compressors/expanders.

Modeling and Standards

Argonne has extensive experience in modeling fuel cell systems and analyzing their performance. Models range in complexity from detailed but idealized spreadsheets to rigorous, theoretically grounded simulations. Researchers can model or test individual components or entire systems This work assists U.S. Department of Energy managers in setting priorities for their technology development programs. Argonne is also directly involved in setting